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A STUDY OF ABNORMAL OCCURRENCE REPORTS

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Abstract

A detailed study of failure and occurrence reports from five U.S. nuclear reactors. Data concerning the frequency of failure causes and multifailure incidents are given.

Methods of failure classification are discussed.

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Foreword

Reports are prepared by engineers in U.S. nuclear power plants for a wide range of component failures and similar occurrences. The precise reporting requirements are specified in the U.S. Nuclear Regulatory Commissions Regulatory Guide 1.16. Until 1974, such reports were termed Abnormal Occurrence reports, but since then the term "Abnormal Occurrence reports" has been reserved for those occurrences which have some safety significance. What were earlier termed "Abnormal Occurrences" are now as a general class, termed Reportable Occurrences.

The reports are published by the US NRC. The work here concerns a study of "Abnormal Occurrence Reports", using the pre 1974 definition and data up to and including spring 1974. The data cover a wide range of occurrence types. In particular they give component failure data mostly of relatively unimportant individual component failures, such as miscalibration of a single redundant instrument, but in some cases for failures of some engineering significance. The reports are much less formal than those required for reliability data banks. They give considerably more background information concerning the cause and nature of failures than do reliability data banks; and also much more information concerning consequences and interrelationships between separate failures.

For this reason, the reports provide very valuable information, which is relevant not only to the study of nuclear power plant reliability, but also provides insight into the way failures can occur in many different kinds of process plant.

A STUDY OF ABNORMAL OCCURRENCE REPORTS

Introduction

An earlier study (Risø-M-1742) attempted to evaluate the role of design errors in nuclear power plant reliability. The results of that study showed that design error plays a large role in power plant failure: and the surprising result that an unexpectedly large proportion of failure incidents involve several independent component failures.

Several questions arose as a result of that earlier work. One would expect that the role of design error diminishes for individual plants as they grow older. It was decided to investigate the sequence of abnormal occurrence reports from individual reactors over a number of years.

Another question is the extent to which separate failures in multi-failure incidents contribute significantly to the failure consequence. It is possible that several of the failures within an incident have no direct bearing on the extent of failure consequences. They may play an incidental rather than crucial part in the failure sequence.

The remaining area of interest for this study is the problem of common mode failure. The importance of common mode failure was established earlier, but the only datum obtained was a gross figure for the proportion of failures involving common mode effects. Results of the common mode failure study performed here are published separately (Risø-M-1826).

A major element in motivating this study, was the desire to discover the weak points in existing techniques of failure mode analysis of process plant, and to develop the background information for improving those techniques. There are some types of failure for which no systematic analysis technique exists, for example

- wiring errors involving incorrect interconnections
- "system design" errors in control systems
- mechanical blockage and jamming problems arising from loose parts
- errors in written procedures
- human errors due to confusion between procedures or misinterpretation of operating situation.

All of these problems involve complex common mode effects, and it is important to discover to what extent they are important in practice.

The procedure in this study has been to take individual incident reports, and to classify them according to fixed criteria. The nature of the data prevents one from obtaining good statistical data with known significance, but it is felt that qualitative, and "order of magnitude" conclusions can be drawn from the results.

Choice of data

The data used for this study is abnormal occurrence data submitted to the USAEC by operators of light water reactors. The reason for this choice is that the information is readily available, there are consistent criteria for reporting the data (reporting is required by law), and the quality of the reporting is generally excellent. The information differs from that usually available in reliability data banks, in that complete failure incidents are described, often involving several individual component failures.

The choice of reactors for this study was determined by the availability of records for a period of years. Records from the earliest years of reactor operation were however not available to the author. There has been a change in style of reporting over a number of years, and this has to some extent negated the value of the data as a record of "design error" evolution.

Classification of occurrences

For each occurrence report, the date, six month period number (from reactor start up), operating state at the time of occurrence, and method of failure discovery were recorded. Most failures are detected during surveillance testing, some via special inspections, but many are discovered as "actual" failure incidents which interfere with plant operation. In many cases a failed condition existed over a considerable period, but the plant state recorded was nevertheless the plant state at the time the failure was discovered. In virtually all cases it is true that a latent failure, discovered during surveillance or special tests, has existed while the plant was operating.

Each individual component failure was recorded separately for each incident, and in some cases there were several failures contributing to the incident.

OP	Plant operational, generating power.
SU	Plant was in start up phase.
SD	Plant was in shut down phase.
CS	Plant was in cold shut down state.
RF	Plant was shut down for refuelling.

Table 1. Classification of plant states at the time of failure discovery.

ACT	"Actual" incident - occurs during normal operation of component.
SUR	Failure discovered during surveillance testing.
PM	Failure discovered during post maintenance testing of the failed component.
COM	Failure discovered during commissioning tests.
SI	Failure discovered during special inspection, as a result of suspected incipient failure, or as a result of information from other plants.
SU	Failure discovered during start up testing.

Table 2. Classification of "mode of discovery" of failures.

In a study such as this, which is concerned with the cause of failure, it is important to define the term component failure carefully. A failure is deemed to have occurred, if a component is incapable of fulfilling its function, in spite of the fact that inputs such as power supplies, control signals, mechanical support, etc. are within the limits specified for the component. Failures due to incorrect input are judged to be consequent failures, and were recorded for interest, but were excluded from statistical analyses. Failures due to environmental changes were recorded as component failures, unless the environmental change was a result of some earlier component failure in which case they were classified as consequent failures, and again omitted from statistical analyses.

The degree to which a plant is divided into "components" also affects the number of component failures recorded. In this study, a standard level of division into components was used, as expressed by table 3. However, where a component was part of a larger component or subsystem, this fact was recorded by concatenating component and system names.

Amplifier	AM	Motor starter	MS
Annunciaton	AN	Potentiometer	POT
Battery	BY	Recorder	REC
Battery charger	BC	Lightning arrester	LA
Cable	CAB	Ground switch	GS
Capacitor	CAP	Relay	RE
Circuit breaker	CB	Relay or switch contact	CN
Magnetic clutch	CL	Reset switch	RS
Control switch	CS	Resistor	RST
Coil	CO	Signal comparator	COMP
Diode	DI	Pressure switch	PS
Detector	DE	Torque switch	TQS
DC power supply	DC	Temperature switch	TS
Flow switch	FS	Fuse	FU
Heater	HG	Generator	GE
Input module	IM	Heat tracing	HT
Inverter (solidstate)	IN	Test button	SB
Level switch	LVL	Thermal overload	OL
Lamp	LMP	Transformer	TFMR
Limit switch	LMT	Transmitter	TMTR
Manual switch	SW	Wire	W
Meter, guage	GG	Solenoid	SOL
Motor	MO		

Table 3A. Electrical component coding.

Accumulator	AC	Refrigeration unit	RF
Blower	BL	Sluice gate	SL
Control rod drive	CRD	Sump	SP
Control rod	CR	Tank	TK
Cover plate	COV	Tubing	TUB
Core	COR	Turbine	TURB
Damper	DM	Condenser	COND
Diesel	DIES	Vent	VT
Expansion joint	XJ	Well	WL
Filter, strainer	FL	Valve, check	CV
Flexible pipe, hose	FLEX	explosive	EV
Fuel	F	hydraulic	HV
Gas bottle	GB	motorised	MV
Gaskat	GK	pneumatic	AV
Heat exchanger	HEX	relief	RV
Insulation (thermal)	TINS	manual	XV
Ion exchanger	IEX	safety	SV
Noggle	NZ	stop	DV
Orifice	OR	vacuum relief	VV
Pipe	PP	main steam isolation	MSIV
Pipe Cap	CP	solenoid	KV
Pipe Support	CUP	Seal	SL
Pressure vessel	PV	Actuating mechanism	ACT
Pump	PM		

Table 3B. Mechanical component coding.

Event sequence

The structure of event sequences has a direct bearing on the way in which failure records are interpreted and used in later failure mode analyses. Failures were classified as spontaneous, gradual, misoperation, latent or consequent.

A spontaneous failure is one which occurs at the time of the incident and serves to start the incident. The classification of "gradual" failures was introduced because it was difficult to describe some kinds of initial failures

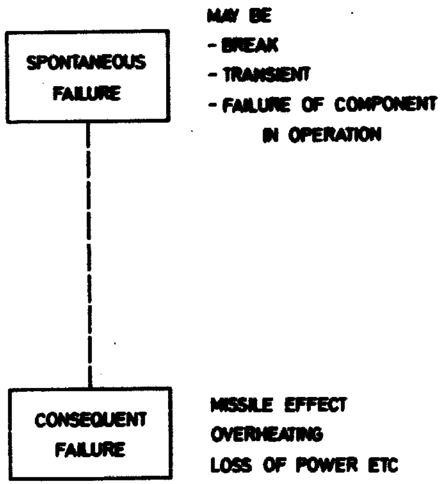

Fig. 1 Event sequence with spontaneous and consequent failures

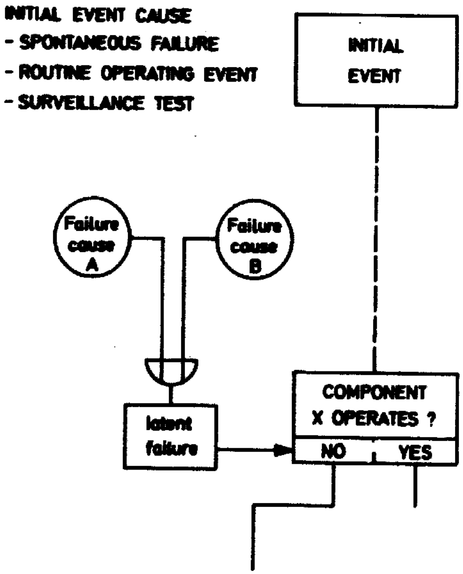

Fig. 2 Event sequence with latent failure

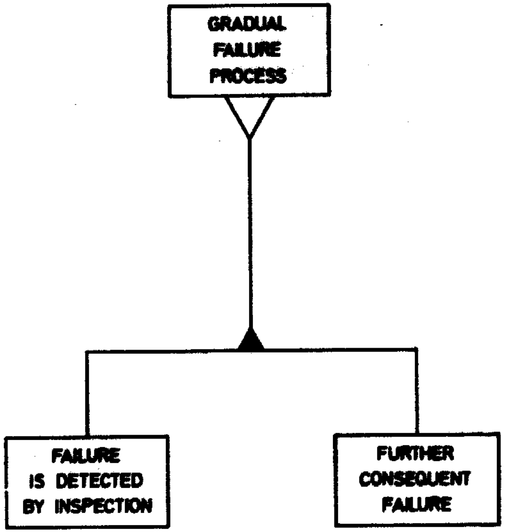

Fig. 3 Alternative failure sequences resulting from gradual failure.

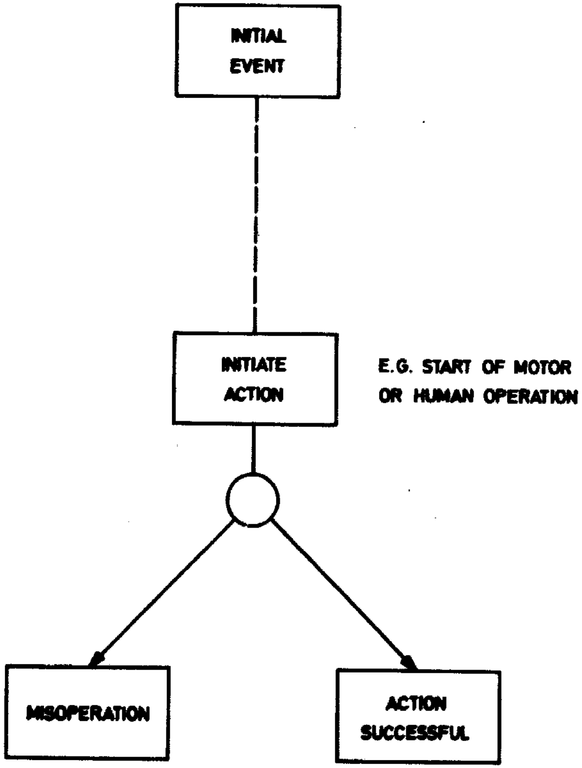

Fig. 4. Event sequences including misoperation

as spontaneous, for example slow leaks which are detected after they have caused further damage.

Latent failures occur in components which are called on to work intermittently. Such components may exist in a failed state, which is "revealed" when the component is tested or is called on to operate.

Misoperation failures are those which occur when a component or operator is called on to carry out such operation, and which occur while the component or operator is carrying out the operation.

Consequent failures are those which occur as a direct result of some earlier failure.

S	Spontaneous
G	Gradual
L	Latent
M	Misoperation
C	Consequent

Table 4. Classification of failures according to how they are triggered.

Further classification of "consequent" failures is possible - input failures (I) (command failures), overload or stress failures (secondary failures) (O), and direct effect failures (D). Such classification is often made in failure mode analysis studies. But such classification was made only for common mode failures, in this study.

Symbolic description of the different kinds of failure are shown in fig. 1 to 4 (see Risø Report Risø-M-1743). For each of the different kinds of failure, a different model is required to describe failure probability.

As a result of the study, some of the initial ideas on classification of failures were revised, and these ideas, which were not used in the study itself, are given in Appendix 1.

One of the important objectives of this study was to observe the number of failure events occurring in actual failure sequences. For this purpose, failures detected by testing were ignored. Also, several failures occurring within similar components due to a common mode effect, were treated as single failures. Consequent failures which were certain to occur, given earlier failures, in the sequence were ignored. But consequent failures which involved some probability factor, such as destruction of components by impinging steam jets, were counted as separate failures.

Common mode and coupled failures

As part of the study of multiple failures, a study was made of common mode and coupled failures in similar plant components. The results of this study are presented in a separate report.

Failure cause

The objective in this study has been to come as close as possible to the original cause of failure. Failure causes are classified at two levels, as shown in table 4. The second level of classification is much less certain than the first. In the case of operator and maintenance errors, the subclassification was completely experimental.

To maintain consistency of cause classification it is important to have clear criteria. An error was considered a design error if it was explicitly described as such in the abnormal occurrence report, if it was one of a long series of similar failures with very high failure rate, or if the design was modified as a result of the failure. A similar criterion was used for classifying procedural errors. Failures were classed as operator errors if this was explicitly stated in the abnormal occurrence report, and similarly for maintenance and installation errors. (This can lead to underestimation of operator errors).

Random component failures were recorded in those cases where a simple standard mechanism of component failure was involved e.g. bearing leakage, shorting of a relay coil etc., and in which no excessive grouping of failures of a similar kind occurred.

In some cases, more than one cause of component failure could be discovered. In other cases, it was difficult to judge between two alternative failure causes. In these cases, fractional contributions to failure classes were recorded, an equal fraction to each contributing cause.

In many cases, the same kind of failure occurred in the same component several times in the course of a few years. These cases were counted as single failures in determining relative importance of different failure causes (though all incidents were counted in determining common mode failure proportions). If one does not count failure causes in this way, then some frequently occurring failure types come to dominate the distribution of causes. The proportion of design error failures, in particular, becomes inflated.

Cause		Cause subclass	
C	Random component failure	M	Mechanical
		E	Electrical
D	Design error	U	Problem unknown at design time
		C	Complex system interactions
		I	Interdisciplinary problems
		O	Oversight
		K	Communication problems
		Z	Calculation, sizing problems
		S	Component selection problem
O	Operator error	O	Omission
		X	Unnecessary extra operation
		W	Wrong target of operation
		E	Error in amount of operation
		S	Error in operation sequence
		P	Wrong procedure used
		J	Judgement of quantity
		C	Communication problem
		R	Lack of recognition of danger situation
		M	Misrecognition of danger situation

Table 4. Coding for causes of failure.

Cause		Cause subclass	
M	Maintenance error	A	Adjustment (of instruments, switches)
I	Installation error		
		O	Omission of step in installation, repair
		P	Positioning of component
		M	Misuse of component, handling problem
		B	activation of other equipment not under repair
		C	Choice of component to install, repair
		I	Interchange of two components, cables etc.
		Q	Quality of join
P	Procedure error	O	Omission of subprocedure
		C	Extra control, checking required
		M	Procedure open to misinterpretation
		U	Effect unknown before failure
		W	Procedure wrong
F	Fabrication fault		
?	Cause unknown		

Table 4. Continued.

Data

Abnormal occurrence reports from five reactors were classified for reactors with start up dates in 1962, 1963, 1967, 1969, and 197o. Abnormal occurrence reports were generally available to the author only from the later years of reactor operation (from 1969 onward).

Both the number and character of abnormal occurrences varied greatly from reactor to reactor. The variation could have arisen from the different quantity and type of equipment at the reactor plant, as well as differences in reliability of components. However, it was hoped that by concentrating on the proportion of occurrences of different types, meaningful conclusions could be drawn.

As can be seen from fig. 7 not too much significance can be attached to the actual numbers of abnormal occurrence reports for successive years.

In addition to abnormal occurrence reports, some "unusual event" reports were included in the analysis, where the reports concern safety related or pressure boundary equipment (see USAEC safety guide 13.2. for definition of abnormal occurrence, unusual event).

There may be some omissions of abnormal occurrence reports for the reactors studied, though where possible records were checked against semiannual operating reports. On the assumption that omissions are randomly distributed, the effect on proportions of failure types should not be too important.

In all there were 67, 24, 33, 141, 75 abnormal occurrences for the respective reactors.

Causes of failure

Fig. 8 and 9 show how the various causes of failure behave as plants grow older. No significant trends can be detected, the proportion of failures due to respective causes seem if anything more or less constant. But much more data would be required, before trends could be detected beneath the random variations in the data. As has been observed in earlier studies, design error seems to be the dominant cause of failure, followed by random component failure.

Table 5 gives the numbers of failures attributed to particular cause classes, for each of the reactors studied. The pattern is more or less constant, appart from an unusually high proportion of failures attributed to maintenance errors, for one of the older reactors, and a complete lack of reported operator errors for one reactor.

The classification of secondary causes for design, operator, procedure, and maintenance errors are shown in tables 6 to 9. The classifications here are experimental, and should be regarded as indicative rather than definite. Such classifications can be used as a guide to qualitative studies of failure causes.

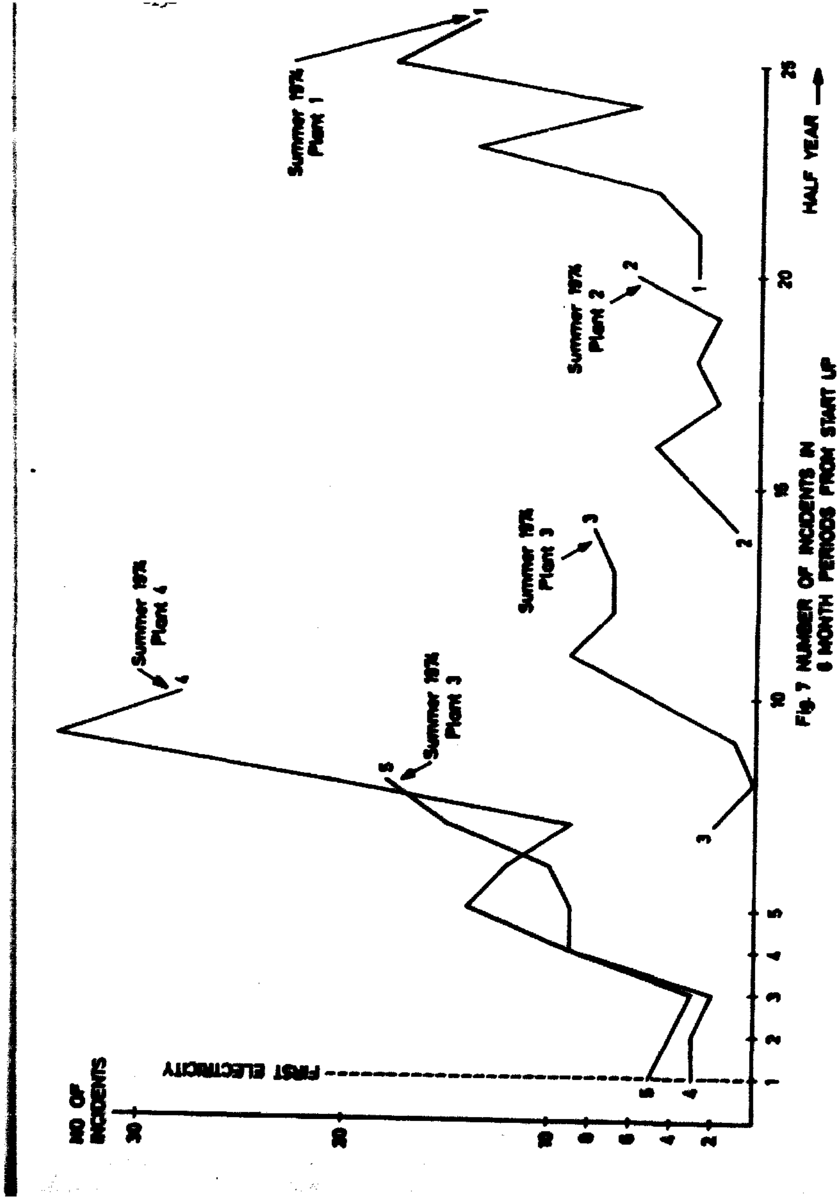

Fig. 7 NUMBER OF INCIDENTS IN 6 MONTH PERIODS FROM START UP

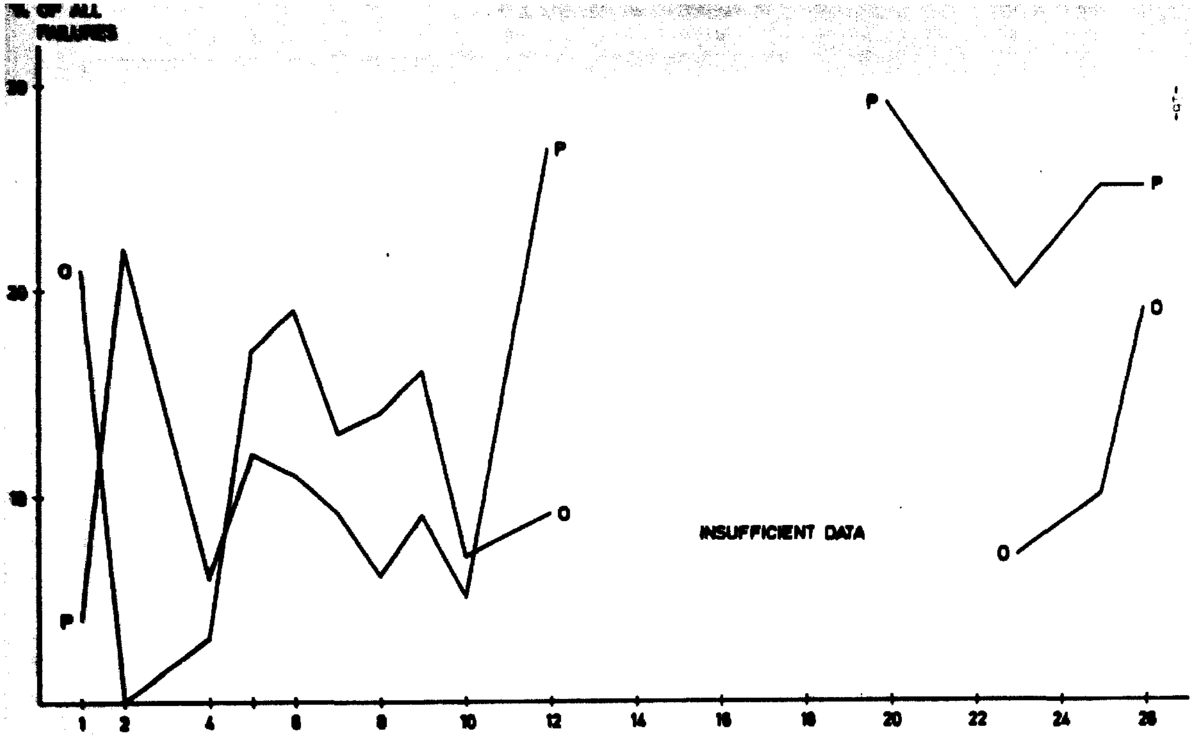

Fig. 8 PROPORTION OF OPERATOR AND PROCEDURE ERRORS

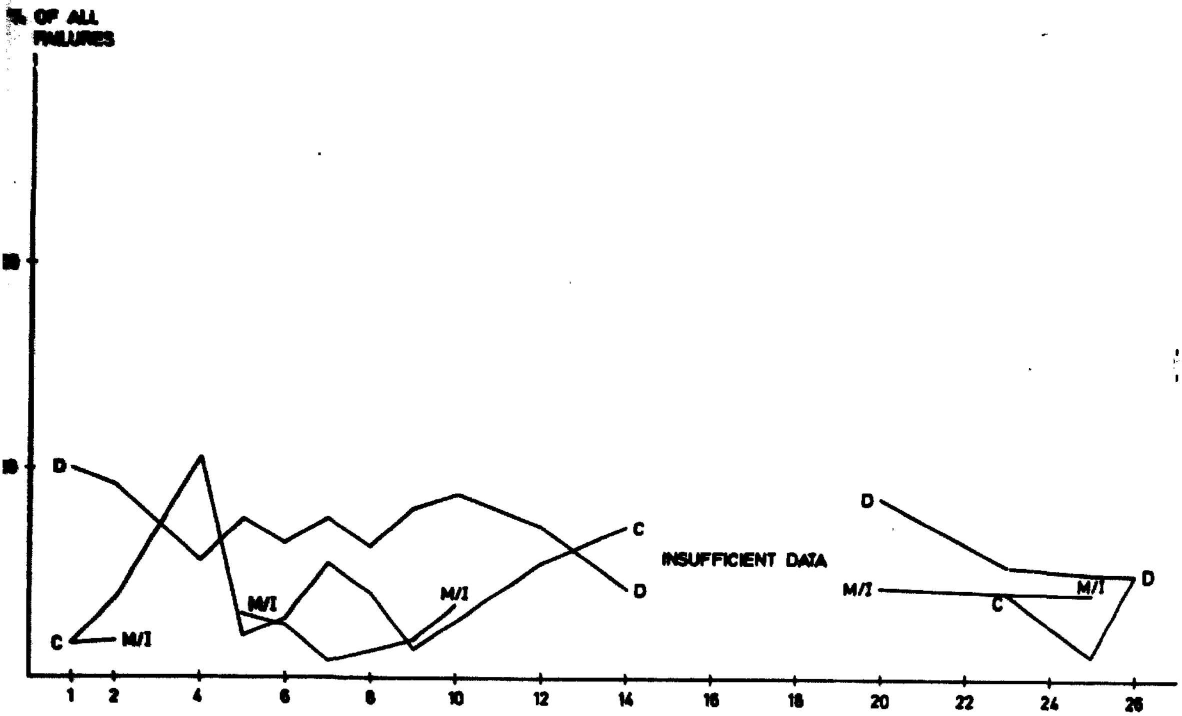

Fig. 9 PROPORTION OF COMPONENT, DESIGN, AND, MAINTENANCE/INSTALLATION ERRORS

Reactor	Design error	Random component failure	Operator error	Error in procedure	Maintenance or installation error	Fabrication error	Cause of failure unknown or unrecorded	Number of individual failures reported
1	37 %	11 %	10 %	18 %	16 %	1 %	7 %	82
2	14	11	11	11	36	0	18	28
3	48	31	0	7	5	0	10	42
4	34	17	12	9	10	0	17	174
5	34	23	19	7	6	3	7	96
ALL	35 %	18 %	12 %	10 %	12 %	1 %	12 %	422

Table 5. Cause classes for component failures.

		%
S	Component selection	14
O	Oversight	17
U	Error due to effect unknown at design time	25
Z	Sizing, dimensioning error	13
C	Error due to lack of recognition of complex system interactions	7
K	Error due to communication problems	1
?	Error with cause unknown or unrecorded	22

Table 6. Design error secondary causes
(Based on 147 occurrences)

		% of error
O	Omission of a step, operation or procedure (reason for omission unknown)	49
P	Wrong procedure used	16
R	Lack of recognition of situation	7
M	Misrecognition of situation	2
S	Error in operation sequence	4
W	Operation applied to wrong target component	4
J	Error of judgement of amount	2
C	Error due to communications problems, lack of communication	4
E	Error in amount of adjustment	2
?	Error due to unknown cause	9

Table 7. Secondary causes of operator errors. (Based on 77 occurrences)

		%
O	Error due to omission of step or procedure	56
U	Error due to omission, because effect was unknown at the time the procedure was defined	16
M	Procedure was open to misinterpretation, unclear	7
F	Wrong test frequency specified	2
W	Wrong procedure specified	2
C	Extra control required - procedure does not contain sufficient cross checks	6
?	Error with unknown cause	14

Table 8. Secondary causes of errors in procedures. (Based on 44 occurrences)

		%
A	Problems with adjustment of instruments, limit, torque switches etc.	22
W	Wrong operation carried out, or right operation carried out wrongly, due to lack of knowledge or expertise	16
B	Spurious activation of other equipment while carrying out tests or repair	9
I	Interchange of two cables	6
U,O	Omission of operation, due either to oversight or to ignorance of requirement	6
P	Error positioning component	3
Q	Problems of quality in soldering, welding	3
R	Error due to lack of recognition of situation	3
C	Error in choice of which component to repair	3
S	Breach of safety regulations	3
?	Error due to unidentified causes	25

Table 9. Secondary causes of installation and maintenance errors.
(Based on 49 occurrences)

It is possible to make some qualitative comments on the results.

A large proportion of design errors involve effects which were unknown before failure occurred. Many failures of this type occur repeatedly, the same component sometimes being repaired several times before the failure is correctly diagnosed. Such incidents underline the value of abnormal occurrence reporting.

Another large group of design errors involve inappropriate choice, of materials, or especially, of instruments. Problems of this kind can be reduced by qualification testing and standardisation, activities which are receiving a great deal of attention from nuclear engineers.

By far the largest proportion of operator errors involve omission or oversight, involving just a single type of plant operations. By their nature, such errors are relatively easy to forsee, and analyse, even in the cases where several components are affected in a common mode fashion. More serious are the errors due to lack of recognition of dangerous situations, misrecognition, application of inappropriate procedures or application of correct procedures to the wrong component. Among installation and maintenanco errors, difficulties in adjusting limit switches and torque switches are outstanding.

Some types of failure are difficult to account for in failure analysis. It is difficult to identify all of the failures of this kind, but the following provides a list of errors which occurred, but for which no systematic failure analysis procedure exists (as yet).

Loose parts jamming	5
electrial circuit omissions or miswiring	5
omission of essential procedural steps, or incorrect steps	3
human decision errors with wide ranging effects	3
established trip levels inappropriate	6
water hammer effects	3

Also, there were some instances of problems present special difficulties in failure mode analysis.

common dependence of several components on one service supply or environment	7

Multifailure incidents

In this study, as in the previous one, the number of multiple failure incidents was high when compared with expectation. At the level of consequence represented by abnormal occurrence reports, there are still a significant number of 4, 5, 6, and 7 fold failure incidents (fig. 8).
This pattern holds true in spite of the fact that

a) failures to several components of the same type, due to the same cause, have been treated as single failures.

b) failures which are a direct consequence of earlier failures, are not counted in arriving at the number of independent failures.

c) failures which do not contribute significantly to the consequences of the incident have been ignored.

Examining the nature of the multiple failure incidents reveals several distinct types,

- blowdown incidents, in which steam is released, causing defects in surrounding components to be revealed, in some cases, and causing a large variety of safety components to be activated.

- multiple human errors. It is clear that in some of these incidents there is coupling between the errors. Once one human being has made an error, others tend to perpetuate it. However, the nature and degree of interdependence of these errors is difficult to determine.

- because of the way that these data are classified, if single component fails to work because its design is inappropriate and its operating procedure is incorrect, the result is counted as a double failure. This "classification effect" is significant in raising the number of 2 and 3 fold failures. It does not contribute significantly to the number of 4, 5, 6 fold failures etc.

By far the largest proportion of failure types in the multiple failure incidents are latent failures revealed during special incident conditions, or revealed when safety equipment is activated.

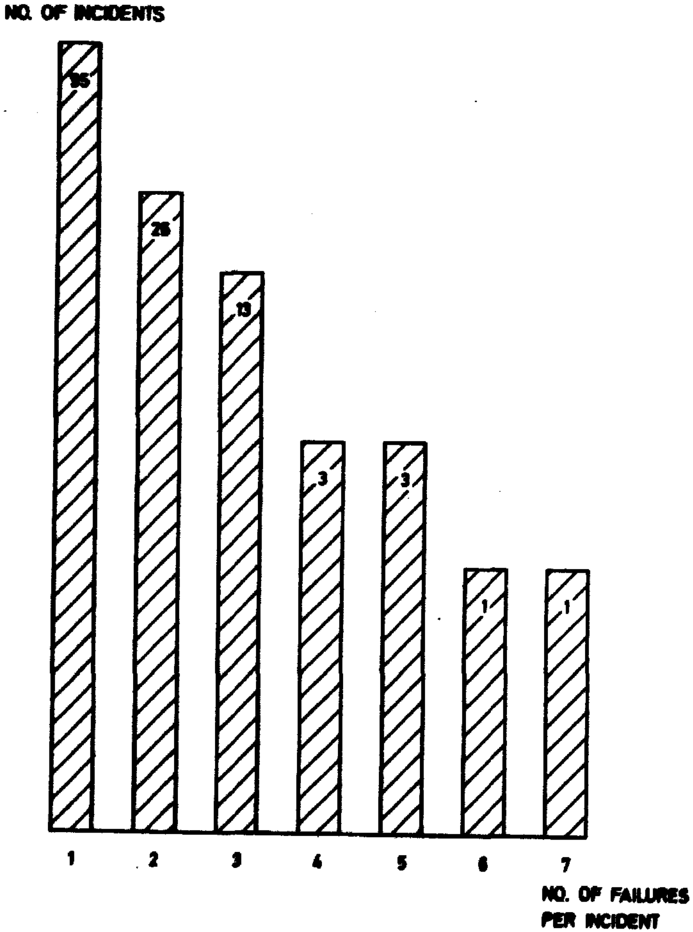

Fig. 8 HISTOGRAM OF MULTIPLE FAILURE INCIDENTS

Conclusions

Conclusions as to the meaning and importance of the kind of results given here have been presented before (Risø-M-1742). The additional data collected here serve merely to reinforce those conclusions which are

1) That design and other human errors are responsible for a significant number of failures and abnormal occurrences.

2) Some "design error" type failures cannot be accounted for in traditional types of reliability analysis.

3) Improvement in particular component reliability performance, in testing, and in standardisation, should be valuable in improving plant reliability, because a small number of component types are responsible for a large proportion of failures.

4) Multiple failure incidents play an unexpectedly large role in abnormal occurrences. Records of interrelationships between failures would be a useful addition to failure statistics data bases.

In addition to these remarks, some conclusions can be offered concerning the type of classification study attempted here.

It would be useful to obtain some standardization of the terms used in classifying different types of failure, according to the way in which failures reveal themselves, the plant state at the time of occurrence and/or discovery, and the triggering mechanism of the failure. The classification used here is self consistent, but is different from schemes used elsewhere.

The classification of primary causes of failure seems acceptable, and is simular to that use by the USAEC (e.g. OOE-OS-001, 1974). However the method of classification used here, attributing a failure to a single class, or using fractions to represent degree of responsibility for a particular cause, is messy. Accepting that a failure may have several causes, and that the percentages of failures due to different causes may total to more than 100%, seems preferable. But if this method of classification is accepted, some definition must be made of how important and unusual an effect must be, before it is accepted as a contributing cause of failure.

The classification of different failure causes into secondary categories was not particularly successful. Often there was insufficient information in the abnormal occurrence reports to make classification precise. And the categories used here often overlapped. The information in such classification should not be used to derive percentages to which different causes are responsible for failures. The information might be used to perform clustering studies, with the hope of finding more clearly identifiable types of failure.

Uncertainty as to cause of failure should not be used as an excuse for assigning two causes to a particular failure. Instead, if there are several clearly alternative causes, this fact should be recorded explicitly (e.g. A/B means either cause A or cause B is involved, C & D/E means either cause C and E are together responsible, or cause E is responsible). Failure for which causes are unknown, should be recorded separately. Only in this way is it possible to interpret the meaning of failure cause data.

A revised system of classifying different failures according to event sequences, is given in appendix 1.

Appendix 1. Classification of failure events

Classification of the different kind of failure events which can enter into event sequences is useful and important, because it indicates the relevance of particular pieces of failure data to different reliability calculation models. In fact, as reliability models become more complex, more complex failure classifications are required. The scheme introduced here is therefore just a particular example of a range of possible schemes which differ in level of detail.

The first distinction is made between failures which are caused by some external event or process, and those which arise with no apparent cause or for which the failure cause is an inherent property of the component. This second group is the one which has been called "random component failure" earlier in this note. These are called spontaneous failures here. Examples are the normal forms of bearing failure, relay contact failure etc., for which no specific cause can be described, or which cannot be prevented in normal engineering practice. Examples of typical causes in the first group of failures are design and installation errors, extreme environmental conditions, misoperation by an operator etc.

A distinction which is equally important for obtaining a reliability model of failure consequences is whether the effects follow instantaneously from the failure, or whether the effects are gradual (e.g. slow leakage of some valuable material).

When components operate intermittently or only occasionally (such as safety systems) or with intermittent load (such as many pneumatic orhydraulic systems) a third distinction becomes important - whether the effects of the failure remain latent, or whether the consequences show themselves immediately. In the case of a latent failure, a failure event occurs at some time. The component is reduced to a state in which it cannot operate according to specifications. When the component is called upon to operate (the failure is triggered), a "failure to operate" occurs.

The definitions of the various failure types are illustrated in fig. 7.

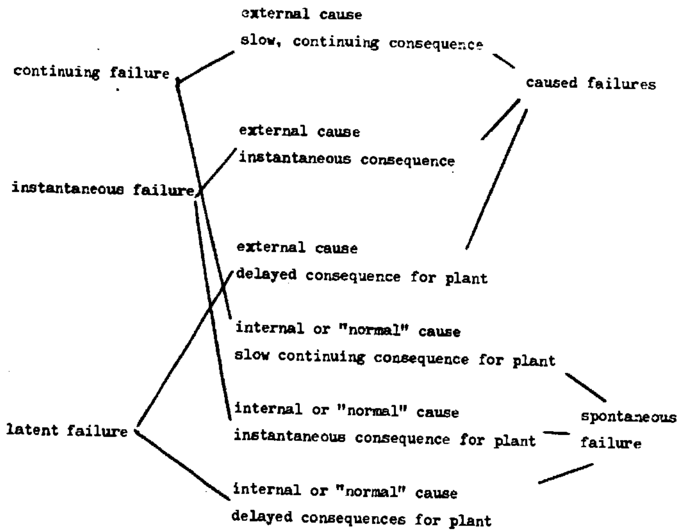

Fig. 7. Definitions of failure classes.

For latent failures, the stage at which the failure is discovered becomes important, especially for systems in which automatic continuous testing and periodic testing is performed.

A latent failure may remain hidden due to the fact that the particular type of error is not exercized or triggered by the test inputs applied. These failures are called "untriggered". Equally, a failure may be triggered, but its effects may not be indicated because the failure alarm outputs and test measurements performed, are inadequate. These failures are called unmonitored. (See fig. 8).

kind of failure involved	Stage at which failure phenomenon occurs continuous operation	during stand-by	on activation
latent	——	latent failure	failure to operate failure on demand
immediate	failure in operation	active failure	misoperation

Table 10. Terms used in describing latent and immediate failure sequences.

A useful distinction in judging the effectiveness of testing, is that between actual failures and failures found under test. For actual failures consequences occur which affect the operation of the plant. The following relation is true.

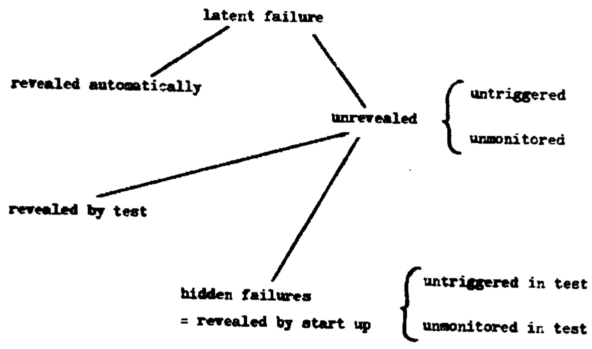

Fig. 8 . Types of latent failure.

Actual failures = hidden failures
+ failures in operation
+ active failures
+ misoperations, not under test

Finally, it is useful, in classifying multiple failure sequences, to indicate whether a failure was initial (initiated the sequence), contributory (independent, but triggered as a result of the initial failure, or increasing the consequences of the initial failure), or consequent (caused by the initial failure).

Appendix 2

DATA

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/ SPONTANEOUS	IMMEDIATE/ REVEALED/CONSEQ.	INITIAL/ CONTRIBUTORY	DESCRIPTION
50-	61				H B Robinson 2 PWR														
37		Apr 28 - 70		EC			D									S C			Safety valve pipe rear missile effects.
			Sept																
47	AG		1	LC	SI		D	O U		GE TS	LS					L			pressure signal not transmitted - cold pipe/ thick oil.
48	AO	Dec 4 - 70	1	LC	SI		?			GE ST	JAM					M			Starter coil thown clear-JAMMED
49		Nov 26 - 70	1	OP	ACT		C	M		CR	LOOS JAM					L			Failure to insert
51	AO	Feb 1 - 71	1	OP	ACT		O/P			RN	MISS								Monitor removed during release of waste.
57	AO	Mar 14 - 71	1	OP	ACT		O D D	O					4	2	4	M L L CI CD CD	S		Forgot to stop DC pump test Lack of alarm Common dependence of AC and DC power Trip of oil pumps Damage to turbine bearings Damage to circulation pumps

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/ SPONTANEOUS	IMMEDIATE/ REVEALED/CONSEQ.	INITIAL/ CONTRIBUTORY	DESCRIPTION 2
63	AO	Jan 28 - 71	2				D		RW							G			Inadequate rad wast
64	AO	Jun 28	2		SUR		O	U	HE				4	2	Y	G			Corrosion? of steam generator
70 75	AO	May 14	2		SUR		D	U	CR RPS		BRK		4	2 ?4	Y 3 occasions	L			Broken, tripping
72 82	AO	Aug 22 - 71	2	OP	ACT		D		HE SAMPL		LK		4	?	4	G			Leak in sample heat exchanger - 3 times
83	AO	Jan 17 - 72	3						GE										High pressure trip - see later
85	AO	Jan 3 - 72	3		SUR		C	M	SV		Dirt					L			Dirt in air supply to solenoid valve
87	AO	Feb 15 - 72	3		SUR		D	U	GE				4	2 not simultaneously	Y	L			High crank case pressure
91	AO	May 8 - 72	4	CS	ACT		C		HE RHR		LK					G			
97	AO	June 7 - 72	4		SUR		F		PM CS		STK					L			Pump binding

[illegible]	[illegible]	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
98	AO	May [illegible] - [illegible]	[illegible]		ACT		[illegible]	[illegible]	[illegible]				[illegible]	[illegible]		[illegible]			[illegible]
100	AO	[illegible]	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
101	AO	July [illegible] - [illegible]	[illegible]	[illegible]	SUR ACT		[illegible]	[illegible]	[illegible]	[illegible]						[illegible]			
											[illegible]	[illegible]							
102	AO	July [illegible]	[illegible]	[illegible]	ACT		[illegible]		[illegible] RHR [illegible]	[illegible]			[illegible]			[illegible]	[illegible]		[illegible]
109	AO	July [illegible]	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible]							[illegible]			
	AO	Oct [illegible] - 72	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible] Mechan[illegible]							[illegible]			[illegible]
122		Oct [illegible] - [illegible]	[illegible]		ACT		[illegible]	[illegible]	PM [illegible]				[illegible]		[illegible]	[illegible]			[illegible]
123 128	AO	Oct 16	[illegible]		ACT		[illegible]	[illegible]	[illegible]							[illegible]			[illegible]
	UE	Nov [illegible]	[illegible]				[illegible]	[illegible]	[illegible]		[illegible]		[illegible]	[illegible]		[illegible]			[illegible]

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD [illegible]	OPERATING [illegible] OF PLANT	DISCOVERY [illegible]	SERIOUS?	CAUSE	CAUSE CATEGORY	COMPONENT [illegible]	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	ANNUAL [illegible] EFFECT	[illegible]	[illegible]	LATENT/ MONITORED	IMMEDIATELY REVEALED	[illegible]	[illegible]
128	AO	Nov 5	5	OP	ACT											S			Electrical load rejection valve [illegible]
																[illegible]			Transient
																			Manual trip
							D	U	RV ADPS							S			Valve [illegible] open [illegible]
																			[illegible]
							D	U	RV ADPS							S			Valve [illegible] open [illegible]
							M	A	IS, MV, ECCS		ADA					[illegible]			ECCS low pressure trip
130	AO	May 15	4	CS	ACT		C	M	SL, PM RHR		IX					S			
	AO	July 7 - 72	4		SUR		C/D	M	MV, ECCS		BLK		+	[illegible]	+	M			ECCS valves would [illegible] close, boric acid blockage
141	AO	Jan 15 - 73	5		ACT		M/O	Safe					[illegible]	[illegible]	[illegible]	M			[illegible] rules about operation → radiation overdose.

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
143	AO	Dec [illegible] - 7[illegible]	[illegible]	[illegible]	ACT		 M	M M, [illegible] M [illegible]								D V			[illegible]
146			[illegible]		ACT		I P I	[illegible] [illegible] P M	SA HE [illegible] HE							I V C V			[illegible]
166	AO	April 1o - 7[illegible]	6		ACT		O	O, P M	[illegible] RV		IX					M	I		[illegible] piping overpressurized [illegible]
167	AO	Mar [illegible]	[illegible]		ACT		I	I								I			[illegible] → new procedur
172	AO	Apr 23 - 7[illegible]	6		ACT		[illegible] D D	[illegible]	RWST							M I I	[illegible]		[illegible] New alarm provided [illegible] overflow, [illegible]

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE COMPONENTS	LATENT/ SPONTANEOUS	IMMEDIATELY REVEALED/ [illegible]	INITIAL [illegible]	[illegible] 6
186	AO	Jun 6 - 73	6		ACT		O P D M ?	O C K B	XV. C.ECC XV.PS. C.ECC LS.				Y	3	4	M L L S I	CMF		Vent valves open on contain vent pressure measurement Valves were [illegible] on drawing
197	AO	Jun 73	6		ACT				RPS										Turbine trip did not lead to reactor trip immediately, but from high pressure 7 sec. later.
212	AO	Aug 13	6		SIR		D	Z	AC							C			Set point calculation error - too low
	AO	Aug 23	6		ACT		O	confusion O								M			→ relase 1.49 [illegible]
225	AO	July 1[illegible]	6		ACT		F		CS. BL				Y	all ?	4	M			Spring ~~alignection~~ in over current protector
226	AO	July 1[illegible]	6		ACT		D O M	 O O	CB. PM. ECC				Y	all 3 or	N 4	L M L	 CMF		All circuit breakers type westinghouse DB-50 replaced omitted testing of S-by S O testing after replacement. Overcurrent setting not adjusted → spurious trips.

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	AO	Aug [illegible] - [illegible]	-		[illegible]		[illegible]		[illegible]				[illegible]	[illegible]	[illegible]	[illegible]			Error [illegible]
284	AO	Oct [illegible] - [illegible]		[illegible]	[illegible]		[illegible]		[illegible]						[illegible]	[illegible]			[illegible]
271	AO	Oct [illegible]		[illegible]	[illegible]		[illegible]	[illegible]								[illegible]			[illegible]
[illegible]	AO	Oct [illegible] - [illegible]		[illegible]	[illegible]		[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	Y	[illegible]		
282	AO	Nov [illegible] - [illegible] - [illegible]		[illegible]	[illegible]		[illegible]	M	HE		[illegible]					[illegible]			[illegible]
29[illegible]	AO73 - 71	Dec [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	M	[illegible] M							[illegible]			
291	AO	Aug 25 Dec -	-		ACT ACT		[illegible]	[illegible]	FW. HFS		[illegible]		[illegible]		[illegible]	[illegible]			Two failures
294	AO		[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]			[illegible]			Several [illegible] parts [illegible] steam generator - [illegible]
	AOB - 72	Dec 21 - [illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible] HFS		[illegible]		[illegible]	-	[illegible]	[illegible]			All four trip breakers [illegible] friction problems - failing to trip, intermittently

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD	[illegible]	DISCOVERY [illegible]	SERI[illegible]	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	[illegible] EFFECT	COMPONENT [illegible]	COMPONENT [illegible]	LATENT/ DORMANT [illegible]	IMMEDIATE [illegible]	[illegible]	DESCRIPTION 8
300		Dec 4	7	OP	ACT		D	U	PH		BRK					G			Jamming of seismic restraint shoe - breakage of restraint grouting
302	74-1	Jan 3 - 74	7	OP	SUR		O	M	PP		BCK					L			Boric acid dilution
304		Jan 16 - 74	7	OP	ACT			E O	NM				Y	2	4	L	CMF		Computer data value error
305	AO	Nov 22	7	OP	ACT		F		TUB HE		COR					G			Tube leak due to corrosion around arc strike
308	AO 74 3	Jan 25	7	OP	ACT		?		PP PS		BRK					G			Instrumentairline broken
									MV. TURB							C			Failure to close -- trip
							C	E	FV. CRD			CIR				L			down place - refusal to restart
318 321	AO 73-4	Feb 6 74	7	OP	ACT		C/I		W. FAN			CIR				L			
319	AO	Feb 6	7	OP	ACT		O	O								L	S		Door to airlock not locked

DOCKET NUMBER	[illegible] NUMBER	DATE																	
[illegible]	AO 74- [illegible]	Mar [illegible]								[illegible]									[illegible]
341 356	74 8	April [illegible]	[illegible]		[illegible]				[illegible]		[illegible]								[illegible]
[illegible]	[illegible]	Apr [illegible]	[illegible]	[illegible]	[illegible]				[illegible]										[illegible]
[illegible]		Apr [illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]										[illegible]
364	AC	May [illegible]	[illegible]	[illegible]	[illegible]				[illegible]		[illegible]								[illegible]
368	UE	Apr [illegible] Apr [illegible]	[illegible]	[illegible]	[illegible]		[illegible]		[illegible]		[illegible]								[illegible]
370	UE	May [illegible]	[illegible]	[illegible]	ACT			[illegible]	[illegible]		[illegible]				[illegible]				

DOCKET NUMBER	[illegible] NUMBER	DATE																	
373	UE	May 6	8	RF	ACT		O	S	IR		MISC					2	[illegible]		[illegible] with [illegible]
383	UE	May [illegible]	8		ACT		D	Z			[illegible]					[illegible]			[illegible]
390	AO	May [illegible]	8	RF	ACT		D	[illegible]	[illegible]				Y		[illegible]	I			Exc [illegible]
389	AO	July 1	8				[illegible]												
398	AO 74 -11		8				O	O								M	[illegible]		[illegible]
401	AO 74 -13	June 1[illegible]	8		ACT		O	R								M	[illegible]		Operator [illegible]
							D	O								I			[illegible]
406	AO 74 -13	July16	8	OP	SUR		[illegible]	M	S[illegible] UE							[illegible]			[illegible] corr.
407	74 14	July16	8	OP	SUR														
							C	M	MV AFWS		STK BRK					[illegible]			Double valve failure [illegible]
							I	F	MV AFW		CIR					I			

DOCKET NUMBER	DOCUMENT NUMBER	DATE
AC	AC	[illegible]
[illegible]	74 17	Aug [illegible]
[illegible]	74 16	Aug [illegible]
[illegible]	74 19	Aug [illegible]

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
50-21	3	[illegible]			[illegible]											[illegible]			
123	71-[illegible]			[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]
126		JAN 7[illegible]		[illegible]	[illegible]		[illegible]		[illegible]			[illegible]				[illegible]			Safety [illegible] header under strength
133	AO 72-[illegible]			[illegible]	A[illegible]		[illegible]		[illegible]		[illegible]	[illegible]				[illegible]			Cracking containment purge valve [illegible] leak alarm [illegible]
							[illegible]		- [illegible] alarm [illegible]										
							[illegible]		- [illegible] [illegible] freezing										
162		[illegible].71		[illegible]		[illegible]	[illegible]									L			Potential for flooding safety related equipment
163	AO 72-[illegible]	Oct.72		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				L	P		Reactor coolant let down valve switch fail
169				[illegible]		[illegible]	[illegible]												Change design of rad waste system to give lower site boundary dose
173	AO 73-1					[illegible]	E, [illegible]	E	[illegible] E[illegible]			[illegible]	Y	[illegible]	N	L	P		Level switch light source failed

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
174	AO 72-4	DEC 72		OP	ACT	11	D	U	XV C	F	CRK	CI	Y	I	N	S	I	I	Same valve as in 133, - water freezing crack
[illegible]	AO 72-[illegible]					11													
178		Feb73			SI	11	D	U	W RL				Y	I	N	L			Common circuit breaker bodies for circuit breakers give CMF potential
								F	RHR										
							D	U	W,RL BL C				Y	I	N	L			
181	AO 73-2	Feb73		OP	SUR	11	C	E	DI RE RPS		W?	CI	N			L	P	C	Light diode in meter relay erratic
							D	G											Meter relays are being replaced
	AO-73-3	Mar73		OP	SUR	12	O	M	PT GEN		LOOS	CI				L	R	C	Loose pot on generator regulator
							P	O											
188		Mar73				12	O P												Surveillance testing omitted, procedure revised

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX [illegible]	[illegible] OF [illegible]	[illegible]	SERI[illegible]	CAUS[illegible]	CAUSE CATEGORY	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	DESCRIPTION
200	AO																		Same as AO 7[illegible]-[illegible]
208	73-4	Feb73	11	OP	ACT		D	M	KV	K	LK,	CI				L	F	C	
									C		JAM								
220	AO 73-5		12		ACT		C		MV C	L	CPK	RI				C	I	I	Sampling line isolation valve 270° crack around seat
224	AO 73-7		12				D		MV.		TIM					L	R	C	Let down valve opened too slowly - causing relief valv
									RV. C		LK					L	C	C	To blow, then leaked, due to - procedural error minor LOCA,
							P	U								L			radioactivity release
225	AO 73-6	June73	12	OP	ACT		D		AV. COOLANT CLEAN		BRK LY	CI				L	R	C	purification line torn - overtorqueing - fit torque switch - Minor LOCA, release radioactivity
	AO		12	OP	ACT		D	O	Bolts		BRK COR	CI	Y	13 4	Y steam	S generators	I	I	Overstressed hold down bolts on steam gen

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
239	AO 73-10		13	OP	ACT		D		FL. PS. MI			CI	Y	[illegible]	Y	L	F	[illegible]	Motor control centre power supply failure
240	AO 73-9	Oct73	13	OP	SUP		M,		FL.		JAM	CI	Y	[illegible]	[illegible]	M	F	[illegible]	Voltage sensing relay covers not tight
							D, T	U											Too low contact pressure Post maintenance test did not detect incident
245	AO 73-11	Nov73	13	OP	ACT		D	S	MV.		DUP	CI	Y	M	N	L	F	C	Radioactive waste tank valve leaked
253	AO 73-12	Dec73	13																Same as A[illegible]
257	AO 73-13		13	OP	SUR		C	M	MSIV		JAM	CT				L	F	I	
260	AO 74-2	Jan74	13				C	M					Y	I	Y	S	I	C	Two unit heaters failed
				OP	ACT		C, D	M	FL				Y	I	I	L	C, F	C	Two flow sensor lines froze-
261	AO-74-1	Jan74	13				M, D, T	U	FL.				Y	F	N	L	F	I	Same as AO-73[illegible]

Several components/several causes

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	[illegible] MODE [illegible]	SAFETY [illegible]	IMMEDIATE REVERSAL [illegible]	[illegible]	DESCRIPTION
283	AO 74-3	Jan74	13	OP	ACT		ET									S	I	I	Total loss of external power-ice, relay problem
							?		PM. RHR				Y	5	Y	L			Service water pumps failed on automatic, worked on manual
284	AO 74-4	Mar74	14	OP	ACT		?		SV. FL. GAS		LK					S	G	I	Filter fire spray valve leaked
291	AO 74-5	Mar74	14	CS	ACT		M, C	M	MV.		JAM					L	R	C	Overtightened letdown valve packing
292	AO 74-6	Apr74	14	HS			C	M	V		BLK					S	G	I	Check valve .
312	AO-74-8	May74	14	OP	SUR ACT		D	O	GEN		CIR FIRE		Y	6	2	S	I	C	Transformer winding short → fire Both generators affected by design error.
313	AO 74-[illegible]	Apr74	14	OP	ACT		c	M	SV		CRC LK					S	G	I	Leaking seal on vol.control hydrogen regulator
							C	M	SL.							L	R	C	
320	AO 74-9	May74	14	OP	SUR		D	O	PS		Drift		Y	4	2	L	R	C	Power switch set points drift 'set points too near limit'

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX [illegible]	[illegible]	[illegible]	SERIAL	CAUSE	CAUSE [illegible]	COMPONENT TYPE	FAILURE MODE	FAILURE [illegible]	RECOVERY [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
324	AO 74-1[illegible]	June 74	14	OP	SUP		C									L	P	C	One trip unit
	AO 74-1[illegible]	June74	14	OP	SUR		C	M	MSIV		JAM					L	P	C	Dried out packing

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE MECHANISM	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/SPONTANEOUS	IMMEDIATELY REVEALED	INITIALLY CONTROLLED	DESCRIPTION
50-133		April63		Humboldt Bay BWR Unit 3															
97		17/7/72	14	OP	ACT		ETP									I	I		External transient caused trip of normal power
									COND							L	R		Condenser failed
							M	A	V	D						L	P		Safety valve opened early
							OP	NP									I		Operator failed to recognise SV open
									V	C	JAM					L			- this caused condenser failure condensate return valve thermal overhead trip - Jammed wedge, high closing torque switch.
							PR	Lack								L			Lack of procedure for this kind of incident
							D		INST										Lack of power to Reactor Press water level instruments
53		7Apr71	16	OP	SUR		C	E	Fuse	OC									Off gas isolation valve instruments fuse.
							D												Lack of monitor light
61			16	MT	ACT		D	S	CR				Y	ALL	N	L			Stainless steel control rod follower rivets. Followers removed. Overdose to investigating engineer.
67		8Sept	16				C			JAM									Condensate return valve again

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DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE MECHANISM	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/SPONTANEOUS	IMMEDIATELY REVEALED/SEVERAL	INITIALLY CONTROLLED	DESCRIPTION
76		22Jan72	14	MT	SUR		M			Drift	Water		N			L	R		Low vacuum sensor - water accumulation
78		10July71	16	OP	SUR		?		GEN										Generator voltage drop -
81		24Mar72	17	OP	SUR		MT		GEN										Oil in distributor of propane generator
84		17Apr72	19	OP	SUR		M		GEN										Solenoid fuel stop valve short
		13 Apr	18				?		GEN		JAM								Oil in solenoid
115		26Jan73	19	OP	ACT		OP	O											Radwaste concentrator valve left open - oversight
121		2 Oct72	19				?												Baffle damage
		14Aug72	18				?												Loss of power to emergency condenser condensate return valve.
123		30May73	20	OP	ACT		M		Seal.							M			Shaft seals leaked when demineraliser pump was stopped → motor failure due to arcing.
130		5July73	20	OP	PM		?		GEN										Failed to start
136		31Aug73	20	MT	SUR		M		PS	D	Drift		N			L	R		
142		16Nov73	21	OP	SUR		E	E	RT	B						L	R		Cranking limiter contr. resistor open circuit prevented generator start.
									GEN										
									Q										

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
146		16Jan74	21	OP	ACT		ET												Loss of offsite power, more than 12 hrs due to flood
149		2Jan74	21	OP	ACT		M		PS.	M			S			[illegible]	I		Spring in switch failed - press chamber vacuum relief valve.
152		26Feb74	21	OP	SUP		I		WR RPS TLCS	Q	SNEAK		Y	-	M	L	F		Request for design change by regulatory
157			21	OP	AC		M		SL PM CL	L	W		M			[illegible]	T		Cleanup system pump seal leakage
161			21	OP	SUP		M		RPS	F	BLK		S			L	F		Poison injection valve blockage
121			21				OP PR	?											.

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
50-155		Dec 62			Big	Rock	Point	FeP											
77		29Mar71	19	MT	SUR		M		TP	W	JAM		S			L	R	I	[illegible] roller [illegible] jam
74		29Mar71	19	OP	SUR		[illegible]		OP				I		I	L	R		Change [illegible] orifice size to give
																			indication over wider range
80		1 Oct71	20	OP	SUR		D		DE.	A	MF		W			L	R	I	Loss [illegible] in automatic shut-
																			down sequence, not in manual
82		20May71	19	OP	SUR				TP	W	JAM		I	I	I	L	R	I	[illegible] rod jam [illegible] another roller
83		March71	19	MT	SUR		D		PP.	R	PTI		N			L	R	I	Cracking of poison injection tree
									RPS		RPI								
8?		Aug 71	20	OP	SUR		F		CP		CPT		I	[illegible]	[illegible]		R	I	Cracking in control rod index tube
																			[illegible] of four experimental rods
		15July 71	20	OP	SUR		M		PM.	L	LK		S			L	R	I	Loss of priming water in generator
									GE										cooling pump
92		Sept71	20	OP	SUR		L									L	R	I	Added operation hours counter to
																			sump pump for improved leak detectio
							L									L			
							D,F									L			Improved detection small leaks - low
																			level make up water alarm adjusted
							F									L			More rapid depressurization after
																			LOCA

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATION OF PLANT	DISCOVERY TYPE	SERIOUSNESS	CAUSE	CAUSE [illegible]	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
							D	R											Change in activation of core spray
							D	R											Extra feed water supply
105		Jan 72	21	OP	ACT	21	ET									S	I	I	Storm caused 13 short circuits
									CB		OH					C	C	C	Oil circuit breaker overheated
							M		CB		STK					L	R	R	Stuck contact, overcurrent relay
									QS										
							MS		MV.		STK					L	R	C	Torque switch set wrongly + over-
									RCICS		OH								heating valve motor
							D	U,C	FP		SIPHON					L	R	C	Fuel pool siphon
109		Feb 71	19	OP	SUR		?		SOURCE		COR		Y	2	Y	S	R		
111		Mar 72	21	MT	SUR		D	K	EV.				Y	4	Y	L	R	C	Back fire, failure to shear [illegible] shear pin
									RPS.										
115		May 72	21	OP	SUR		M		PS.		Drift					L	R	C	Oil pressure switch
									GE										
116		June 72	22	OP	SUR		M		MV	K	BLK					L	R	C	Off Gass isolation valve failed to
																			close completely
123		Aug 72	22	OP	SUR		D		PP										Off gass hold up pipe rising
124		July 72	22	OP	SUR		D		V.HD	B	OH		Y	2	Y	L	R	C	Overheating 2 cables due to venti-
																			lation failure

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
126		Sept 7[illegible]	[illegible]	[illegible]	SUR		[illegible]		[illegible]								[illegible]				[illegible] armature failure
135		Nov 72	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]			Jamming of isolation valves
137		Dec 72	[illegible]	[illegible]	ACT		[illegible]			[illegible]	[illegible]	[illegible]					[illegible]			[illegible]	Unexplained radiation alarm in
									RE												condenser
141		Mar 73	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]			[illegible]	Loose [illegible] target rods
146		Mar 73	[illegible]	[illegible]	ACT		[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]				[illegible]	[illegible]			[illegible] packing jam
156	AO 10	Apr 73	[illegible]	[illegible]	SUR		[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]				Pump seal leak + loss of prime
																					[illegible] of generator
157	AO 3	Apr 73	[illegible]	[illegible]	SUR		[illegible]	M	PS.		[illegible]	[illegible]					[illegible]	[illegible]			Containment spray
									PS												
	AO 4	Apr 73	[illegible]	[illegible]	SUR		[illegible]	M	PS.		[illegible]	[illegible]	Y				[illegible]				Reactor pressure switches
									PPS												
	AO 5	Apr 73	[illegible]	[illegible]	SUR		[illegible]	[illegible]	PS.		[illegible]	[illegible]	[illegible]				[illegible]				switches, vacuum relief
	AO 6	Apr 73	[illegible]	[illegible]	SUR		M	A	[illegible]			[illegible]	N				[illegible]	[illegible]			Adjustment [illegible]
									PS												
	AO 7		23	[illegible]	SUR		[illegible]	[illegible]	PS.			[illegible]					[illegible]	[illegible]			Calibration, limitchange
									PPS												
	AO 8		[illegible]	[illegible]	SUR		[illegible]	A	[illegible]			[illegible]					[illegible]				[illegible] switch set wrongly -
									PAP												change [illegible]

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	DISCOVERY	SERIOUS	CAUSE	CAUSE [illegible]	COMPONENT	FAILURE [illegible]	FAILURE [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
175	AO 11	Jan 73	23	OP	SUR		C	[illegible]	KV.	[illegible]		CI				L	P	C	Off gas isolation valve left open
				OP	SUR		P	[illegible]	offgas							L	P	C	- procedures altered
176	AO 12	Feb 73	23	OP	SUR		M	A	PS.			CI				L	[illegible]	C	Large error in pressure switch
178									PPS						Ptet				reading
	AO 13		23	OP	SUR		M	C	NM.			CI							in correct connection - power supply
									W.										reversed
									FRS										
							F	U											New procedure top
177	AO 14		24	OP	SUR		C	O,C	NM			CI				S	I	C	Neutron monitor not checked S
179																			during test preliminaries -
							F	O								L	P	C	procedures altered
	AO 15		24	OP	SUR		P	C	NM			CI				L	P	C	Omission of recalibration after
																			rod withdrawal - cured by
							O	O					Y	M	Y	S	I	C	adding alarm circuit SMF
180	AO 16		24	OP	ACT		D	U	HE.	L	LK	CE				S	[illegible]	I	Emergency condenser leak -
									RHR										radiation
183	NE	Oct.73	24	OP	ACT		C	M	KV.	L		CR	Y	[illegible]	Y	S	[illegible]	C	Loss of nitrogen due to loose
							P	O		BLK						L	R	C	fittings
										LOOS									
184	NE	Nov 73	24	OP	SUR		D	O	MV			CS	Y		Y	L	P	C	Valve open timings not in accordance
																			with safety spec.
195	NE	Jan 74	25	OP	PM		M	P	FL		LK					L	P	C	Stack gass monitor filter displaced
							D	U								L	P	C	Test made possible

DOCKET NUMBER	OCCURRENCE NUMBER	DATE																	
197	AO 1	Jan 74	25	[illegible]	ACT		I		NM			I				I	P		Neutron monitor failed. Fail
200																			danger mode
204	AO 2	Mar 74	25	[illegible]	PM		[illegible]		GEN	[illegible]		I				I	[illegible]		Failure of generator to start with
208									OFF										switch in test position.
211	AO 3	Mar 74	25	RS	SUR		I		CR		TIM	R		[illegible]	[illegible]	I	[illegible]		Control rod withdrawal time too
		*Nov 74	24																fast later changed control switches
293																			to prevent fast withdrawal
216	AO 4	Mar 74	25	RF	ACT		[illegible]									S	I	I	Late [illegible] of logic test S
219																			
224	AO 5	Apr 74	25	OP	ACT		I									I	[illegible]	I	Failure to check [illegible] spray for
																			[illegible] years
220	AO 6	Apr 74	25	RF	ACT				PS		[illegible]	I							Leakage [illegible] spray pressure
									S										switch
225	AO 9	Apr 74	25	RF	SUR		I		AV			I				L	R	[illegible]	Design of isolation valve lever
227	AO 7	Apr 74	25	RF	SUR		[illegible]	M	GEN	A	*	I					[illegible]		Generator starter spring
									OFF										
	AO 8	Apr 74	25	RF	ACT		MA	A	AV	[illegible]		[illegible]	[illegible]		[illegible]	I	[illegible]		Misadjustment of off gas isolation
				OP	MA														valve stops - inexperienced
							P	[illegible]											mechanic
230		Apr 74	25				I		CR			[illegible]	[illegible]	[illegible]	[illegible]	L	R		Inverted control rod pins
232	UE2		25	OP	SUR		D	[illegible]	CR	*	*	I	[illegible]	M	[illegible]	I	I	[illegible]	Missing roller on control rod,
																			would not withdraw

DOCKET NUMBER	OCCURRENCE NUMBER	DATE																	
236	AO10	May 74	25	RF	SUR		I	A	V	L	LK	I				L	[illegible]	C	Bolts needed tightening on valve
																			flange
237	AO 11	May 74	25	RF	SUR		D	S	PS		Drift	CI	Y	[illegible]	Y	L	[illegible]	C	New switches - temp problem
									C										
238	AO 13	May 74	25	HS	PM		D	U	CR		TIM	I	Y	[illegible]	Y	I	R	C	Timing problems again
	AO 12	May 74	25	SU	PM		P	M				I	Y	all	inst	S	I	C	Start up check omitted
244	UE 4	Apr 74	25	RF	SUR		D	U	target		Warp	I				L	P	C	Cobalt target warp
250	AO 14	May 74	25	SU	ACT		O	E				OP				S	I	I	Raised reactor power extra 10% over
							P	O											instructions revised procedures
257	AO 15	June74	26	OP	SUR		C	M	PM			CI				L	P	T	Fuel pump - shaft key, service day tank
																			empty
260	UE 6	June74	26	OP	SUR		D	?	BL.C			CE				I	P	C	Containment blower had
																			too high flow
265	AO17	June74	26	HB	SUR		D	W	CR	.	TIM	CE	Y	3	Y	L	P	C	Control rod timing again
									RPS										
267	AO16	June74	26	SD	SUR		C	M	ES.		STK	R				L	R	C	Scram dump tank level switch
									RPS										
269	AO18	June74	26	SD	ACT		O	W	Fuel							S	I	C	Choose wrong fuel bundle for test S

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	SUB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
270	AO19	Jun 74	26	SL	ACT		[illegible]		PM CP RPS				I	All	Y	S	[illegible]	I	Degradation of oil-waterleak. Piston pump cavities flooded
285	UE 7	July74	26	SL	ACT		I	[illegible]	CP RPS		JAM	[illegible]	I	[illegible]	Y	L	F	C	Could not withdraw drives
	UE 8	July 74	26	HS	ACT		[illegible]	U	CR RPS		JAM	SS				L	F	[illegible]	Seven loose parts in all retrieved
	UE 9	June74	26	SD	ACT		I E	M T			BRK	I	Y	[illegible]	[illegible]	L	F	C	Neutron sources broke up - beryllium oxide scattered through plant
290	AO20	July 74	26	RF	ACT		F	O	Post			I	Y			S	I	C	Post incident system valved out of service
291	UE10	July 74	26	RF	ACT		D	E	BOLT BAFFL CORE			I	Y	[illegible]	Y	S	I	I	Baffle bolts broke OMF
	AO21		26				A	[illegible]								M			Failure to report UE 10
	AO22	July74	26	RF	ACT		[illegible]	R	AV.			CL	I	L	Y	L	F	C	Omitted to test valves - subsystem after repair
304	UE11	July74	26	RF	ACT		T		RE. C	[illegible]	CIR OH W	I	Y	[illegible]	N	S	[illegible]	.	Lifetime problem with relay coil - isolation valve trip.
311	AO23	Sept74	26	OF	SUR		I	O	EM. LOCK			CI				S	T	I	Emergency lock test equipment

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE DOMINANT	LATENT/SPONTANEOUS	IMMEDIATE/REVEALED/DORMANT	INITIATING/CONTRIBUTORY	1 af 20
50-2	19				Oyster Creek unit 1 BWR														
58	A0	Oct.69	1	SU	SU		D	U	FL. CR. RPS		BLK. TIM		Y	26	Y	L	R	C	First of a series of problems with control rod filter mesh
59	A0	Sep.69	0	SU	SU		?		AM. TURB.										Major transient, MSIV shut etc.
64		Jan.70	1	SU	SU		I		MSIV		LK		Y	3	Y	L	R	C	MSIV valves linking across seat due to excessive hanger strain
66	A0	Mar.70	1		SUR		C	M	PS RPS		LK	SI							Swage lock fitting leak
							O										C		Operator tightening fitting → scram
							D	C	W. ECC				Y	2	Y	L	R	C	Both condensers disabled
80		Jul.70	2	OP	SUR		D		FS. RAC							L	R	C	Reset level of trip
							P									L	R	C	New operating procedure
110	A0	Sep.27 70	2	OP	ACT		D	C	CTRL CAM. TURB		OSC					L	R	C	Turbine control cam design problem → trip
							C	M	HV. TURB		BLK					L	R	C	Dirt in valve
							C	M	FLHV		MIS					L	C	C	Leakage
							P	O								L	R	C	New procedure [illegible]

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE DOMINANT	LATENT/SPONTANEOUS	IMMEDIATE/REVEALED/DORMANT	INITIATING/CONTRIBUTORY	DESCRIPTION 2 af 20
		Sep.2[illegible] 70	2	OP	BCR		M	M	MV		BRK					L	R	C	Bypass valve linkage rod broken - someone stood on it
114	A0	Nov.70	3	SD	SUR		?		KV		LK		Y	2	?	L	R	C	Tor[illegible]s Oxygen sample valve leak
117	A0	Dec.70	3		SUR		I	A	AV		ADJ JAM		Y	2	Y	L	R	C	Vacuum breaker block valves jamming
135	UE	May 71	4		SUR		C	E	RT. RE		CIR					L C	R	C	Resistor overhested → burn → broke → jammed timer relay
138	A0	Jun.71			SUR		C	M	PS. CS		LOOS →JAM					L	R	C	
139	UE	Jun.71	4		ACT		?		PP							S	G	I	Collapse of package boiler flue
140	A0	Jun.71	4		SUR		D	C	PM. CS		[illegible]		Y	2	Y	L	R	C	Water hammer/vibration in core spray
140	A0	Aug.71	4	OP	ACT		D		TK. RD		OVF					S	G	C	Excess demand for rod waste storage while tank maintenance in progress
		Aug.2	4	OP	SUR		C	M	XV. RS RPS		LK					S	G	C	
		July 6	4	OP	SUR		C, D	M S	KV .095		JAM					L	R	C	
		Aug.17	4	OP	SUR		C	M	RE. CR. RPS		JAM					L	R	C	Dump tank (CR. water hold up) level alarm relay binding

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/SPONTANEOUS	IMMEDIATELY REVEALED/FORCED	CONTRIBUTORY	3 af 20
149	AO	Sep.71	4	OP	SUR		D	S	RT. RE. RHR		CIR		Y	M	N	L	R	C	Same as earlier relay failure - see 50-210-135
152	AO	Dec.71	5	SD	SUR		D	U	MSIV LK		LK		Y	4	N	L	R	C	Same as earlier MSIV leakage
153	AO	Nov.71	5	OP	ACT		O	O	MSIV		JAM BRK					L	R	C	Failure to equalise pressure across valves → . breakage
154	AO	Nov.71	5	SD	ACT		D,P	O	MV. RHR		LK-FIRE		Y	3	N	L	G C	C	- linkage break → failure to close oil leak to motor → burn out
							D?		Hyd								L		Led to water hammer
156	AO	Nov.71	5	OP	ACT		I,D		PP. AS		BRK					S	I	I	Air supply pipe rupture → loss of air → scrams → manual scram Other compressor could take over only after manual valve closed
157	AO	Dec.71	5				?		CO RW		BLK					S	G	I	Blockage of concentrator + plant outage →
									TK. RW								C		Excess activity in tank
							D										L		Lack of spare concentrator
159	AO	Dec.71	5	OP	SUR ACT				SW PM				Y	4	2	L	R	C	Empty fuel oil tank due to pump switch problem
									TK.	GEN						CI			
								C	M										Added to check list
								P	O							L			
								D								L			New annunciator added

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS?	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/SPONTANEOUS	IMMEDIATELY REVEALED/FORCED	CONTRIBUTORY	REMARKS 4 af 20
160	AO	Jan.72	5				I	A	PA		LOOS					L	R	C	Failure 3/4" vent line → orderly shut down
							D	O	PH							L	R	C	
									PP							S	C	C	Due to poor pipe hanger installation, pipe hanger extra needed
																			LOCA
164	AO	Dec.71	5	OP	ACT		D	U	SL CR	I			Y	2	Y	L	R	C	Failure to insert fully-seal leakage
167	AO	Jan.72	5	OP	ACT		O	P								S	I	C	Shut down generator 1 & core spray 2
													Y	2 dissimilar systems					
							P	C								L			New procedure
168	AO	Jan.72	5	OP	ACT		O	S								S	I	I	Loss of buss power
							D	C								L			Extra circuitry to prevent problem
							P	O								L			Extra tagging procedure
																			Many plant subway terms but power
169		Feb.72	5	OP	ACT		O	W, P					Y	several dissimilar systems trip					Operator removed 125 V S DC power → load drop
							D7		PM FW		OSC						M		Feedwater pump scoop tube jammed

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD	OPERATING STATE OF PLANT	DISCOVERY MODE	SERIOUS	CAUSE	CAUSE SUB-CLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	[illegible]	LATENT/CONTINUOUS	MISSION REVERSIBLE	[illegible]	
173		Mar.72	5	OP	SUR		M	O	ES PR PRS		DIRT JAM					L	R	C	Scram dump volume level switch again cf. 11?
176		Mar.72	5				?		TK RW										Rad waste outside tank activity again
177		Mar.72	5	OP	SUR		?		BY GEN		E		Y	2	Y	L	R	C	Two batteries had bad cells
180 246		Apr.72	6	OP	ACT		C	E	MO W		CIR					L	R	C	
							D	C,?	DM C		CIR		Y	4	Y	L	R	?	
182		May 72	6		SUR		I	W	SV		CRK		Y	4	Y	L	R	?	Cracking in two seat bushings
184											STR			out of		16			
205											COR DIRT								
189	A0	May 72	6	OP	ACT		O O O	O O O	Fuel							M	R	?	Fuel bundle misoriented - four people checked
							P	O											New procedure
190				OP	SI		P	Z	BAFFLE										Baffles removed after Monticello incident

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD	OPERATING STATE OF PLANT	DISCOVERY MODE	SERIOUS	CAUSE	CAUSE SUB-CLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	[illegible]	LATENT/CONTINUOUS	MISSION REVERSIBLE	[illegible]	
196		Jun.72	6	SD	ACT		C	E	RE. C		CIR DH					S	I	I	Relay overheating
·		Jun.72	6	SD	ACT				PP. ESWS		BRK LK HYD?					L	R	C	Rubber expansion joint broke on pump start
					SUR		?		MSIV		LK					L	R	C	MSIV leakage again
198		Jun.72	6	OP	ACT		D	S	TS.		LK					S	I	I	Turbine cooling water tower temp. switch lost its gas charge
201	A0	Jul.72	6	OP	ACT		D		TK. RW							L	R	C	Outside waste tank again - high activity
203	A0	Aug.72	6	OP	SUR		C	M	PS.		LOOS					L	R	C	Loose nut - loss of torque in torque tube of PS
204	A0	Aug.72	6	OP	ACT		C	E	RE. CS		DIRT					L	R	C	Containment spray pump circuit breaker open circuit ? dirt
							P	O											Added to check procedures
207	A0	Aug.72	6	SD	ACT		C	M	GG RHR		STK					M	R	C	Failure of containment isolation condensers
							I, D	O	SNUBBER GG		MISS					L	R	C	Missing snubber - full scale reading - sticking
							P		MV		JAM					L	R	C	+ motor valve too tight on seat

REPORT NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUSNESS	CAUSE	CAUSE [illegible]	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON CAUSE EFFECT	NUMBER OF [illegible] AFFECTED	COMMON ROOT [illegible]	LATENT/ SPONTANEOUS	IMMEDIATELY REVEALED	INITIATING OCCURRENCE	COMMENTS
215	A0	Sep.72	6	OP	ACT		I		W RE AC		LOSS SCRAM					S	I	I	Scram due to loose wire + multiple leakage in solenoid valves
							D	S	SL. RV		LF		Y	[illegible]	Y	L	R	[illegible]	
218	A0	Sep.72	6				C	M	SL. PM LCS		LF					S			Liquid control system pump packing leak - maintenance
							D	O	W. PM		CIR					L			Racking out circuit breaker preventing other pump starting
							P	O								L			
221	A0	Nov.72	7				M	I	W. PS		CIR		Y	2	Y	L	R	C	Interchange of isolation condenser pressure switch lines
222	A0	Dec.72	7	OP	SUR		D	S	SO				Y	4, [illegible] GEN	2	L	R	C	
224	A0	Dec.72	7	OP	ACT		C	M	PP. RW		COR					S	I	I	Release of rad waste
							D	C,U								L			

REPORT NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUSNESS	CAUSE	CAUSE [illegible]	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON CAUSE EFFECT	NUMBER OF [illegible] AFFECTED	COMMON ROOT [illegible]	LATENT/ SPONTANEOUS	IMMEDIATELY REVEALED	INITIATING OCCURRENCE	COMMENTS
227	A0	Dec.29 72	7	OP	ACT		D/O		P							S	I	I	Operator opened door of relay cabinet - scram
							D	M	RV		LK BLK					M	R	C	Electromatic relief valve failed to reseat (?why did it open) see below
																			LOCA
							D		RV		BRK		Y	4	Y	L			Broken parts on 4 relief valves
							C	M	RV. PC		LOOS, BLK					L	R	C	Missing parts problem
							C	M	SW		BRK					L	R	C	Mode switch broken, prevented switch to start up mode - MSIV closure
							C	M	MSIV		DIRT, BLK					L	R	C	MSIV failed to close
							D	G	MV. BHR		JAM					L			Failure of isolation condenser, condensate return valve to open
235	A0	Feb.73	7	OP	ACT		D	O	PP. OGS		BLK					L	R	C	Stack gas sample line froze
236	A0	Jan.1 73	7	CS	ACT		P	?								S			Personnel overexposure in clean up after blow-down
237		Feb.73	7	SU	ACT		C	M	SW. CR		CIR					L	R	C	Failed open circuit

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9 af 20
265	A0	Mar.73	7	OP	ACT		O	P								S	I W	I 5	Operator started feed pump with too low feed temp. 5 other occurrences
266		Dec.72	7		SI		D	O	W RE. RPS, RCS				Y	2	Y	L	R	C	Circuit breaker racked out problem again
251	A0	Apr.73	8	CS	SUR		D	O	MV. RHR		JAM					L	R	C	Isolation condenser condensate valbe jam again
252	A0	Apr.73	8	SD	SUR		D		ACT. SV		JAM		Y	5	N	L	R	C	Guide pin for solenoid cocked, jammed - remade with stronger weld
256	A0	Apr.73	8				?	?	V		LF					S	I	I	Chromated water leaked from truck tank valve + radio-activity release
263	A0	May 73	8		SUR		D	S	VV		LF		?			S	I	I	Vacuum relief valve leak
268	A0	May 73	8		SUR		?		MSIV		LK					L	R	C	As in 1971
269		May 73	8		SUR		?		SL. C		LF		?			L	R	C	Manhole seal in containment leaked
	73-10	Jun.73	8		SUR		O P	O P O	GEN				Y	2	Y	L	R	C	Did not set up generators for synchronization
	73-11	Jun. 73	8		ACT		O	O											Omitted to take coolant sample
	73-12	Jun. 73	8		SUR		C	E	RE. CS		CIR OH					L	R	C	
							C	E	W.SW		LOOS					L	R	C	

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	[illegible]	[illegible]	DISCOVERY [illegible]	SEVERITY	CAUSE	CAUSE [illegible]	COMPONENT [illegible]	FAILURE MODE	FAILURE MECHANISM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	DESCRIPTION 10 af 20
290	73-13		8	OP	ACT		?		GEN		GOD					S	I	I	Light ning wrecked transformer +no fuel transfer pump
301	A0 73-15	Jul. 73	8		SUR		C	M	SL. MSIV		LK. TIM					L	R	C	Dash pot seal leak + timing error
									RE. CS										
302	A0	Jul.73	8	OP	ACT		C	M	SL.		LK					S	I	I	Leak > 5 gpm see LOCA
309	73-16								CV FW										
							P	O											
305	A0	Jul.73	8	CS OP	SI		D	S	SH				Y	8	Y	L	R	C	Shock absorber seal failure
	A0	Aug.73	8				D		TK. RW							L	R	C	Excess radioactivity in outside waste tank again
									Condentrator		BLK					S	G	I	
311 314	73-17	Aug.73	8		SUR		D	U	MD GEN		W					L	R	C	
319	73-19		8	SD	ACT		M	A	RE. EP				Y	2	Y	L	R	C	Both power busses out - setting of transfer relay
							D		GEN										Both generators out
							P	O											

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320	73-20		8	SD	ACT		?		RE. MV. RHR		-					L	R	C	New condensate return valve
321	73-21		8	SD	SUR		D	S	SL. SH		LK		Y	21	Y	L	R	C	Snubber seals again
322	73-22		8	CS	SUR		?		MSIV		LK					L	R	C	
330	A0	Oct.73	9		SUR		C	M	PS.		STK					L	R	C	
350	73-23								ADS										
331	A0 73-24	Sep.73	8		SUR		?		MSIV		W LK					L	R	C	See above
332	73-25	Sep.73	8		SUR		?		RE. RHR							L	R	C	
335					SUR		D		MSIV, SL		LK		Y	2	Y	L	R	C	2 more MSIV's leaking - but this time through stem packing
337	A0	Oct.73	9	OP	ACT		O	P								S	I	I	
349	73-26						O O O O P	O O O O O		Adjustment of power trips - calculation incorrect						S S S S L	I I I I R	C C C C C	

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE COMPONENTS	LATENT/SPONTANEOUS	IMMEDIATE/REVEALED/GRADUAL	INITIAL CONTROL	DESCRIPTION 12 af 20
339	A0	Oct.73	9	OP	SUR		C, D	M	RV. SW		COR LK					S	I	I	
342	A0	Oct.73	9	OP	ACT		C	M	HE. FW		LK					G			Radiation release, closed cooling water system leak 14,500 gal.
							D	U								L			
							P	U								L			
346	A0		9	OP	SUR		D	S	SH.		LK			1					Bergen Patterson arrestor again
363	73-30	Dec.73	9		SUR		?		PS. RPS		Drift		Y	4	Y	L	R	C	
365	74-2	Jan.8	9	OP	SUR		?		PS. C		Drift		Y	2	Y	L	R	C	
366	74-1	Jan.4	9	OP	SUR		C, D, P	O	PS. C		Drift ADJ		Y	4	Y	L	R	C	
367	74-3	Jan.13	9	CS	SUR		D	S	SH							L	R	C	Bergen Patterson snubber again
368	74-5		9	CS	SUR		C	M	MSIV		LK					L	R	C	Valve packing back again as Sep. 73
369	74-6	Jan.22	9	SD	ACT		O	J	INERT NO2							L	R	C	Operator used too much NO2 - misjudged amount left - delivery date
370	74-7		9	SU	ACT		?		PS. RPS		Drift					L	R	C	

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/SPONTANEOUS	IMMEDIATE REVEALED	INITIATING CONSEQUENCE	DESCRIPTION 13 af 20
378	73-31		9	OP	ACT		M	I	W. DC				Y	2	Y	S	I	I	Loss of DC power
379	73-32		9		SUR		D	U	XV. MSIV		STK DIRT					L	R	C	Overtravel - pr. transient
380	A0	Nov.21 73	9		ACT		?		RE. ADS. C		OH					S	G	I	
385	73-34	Dec.73	9	OP	SUR		I	Q	NM.							L	R	C	Poor soldered contact
388		Nov.73	9	OP	ACT		D	C	TI. HE. RHR		TIM					L	R	C	
390	A0	Dec.73	9	OP	ACT		D	O	PP. RW		BRK					S	G	C	Radioactivity release after pipe freeze - than
400	74-8	Jan.17	9	HS	SUR		?		TI. RHR		Drift TIM		Y	3	Y	L	R	C	
403	74-4	Jan.22	9	HS	SUR		D, P	S	XV. MSIV		STK					L	R	C	
407	74-9	Jan.31	9	OP	SUR		D	S	PS. C		Drift		Y	2	Y	L	R	C	As 73-30
408	74-10	Feb.8	9	OP	SUR		D		PS. C				Y	2	Y	L	R	C	As 73-30 - these are Barkdale PS's

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415	74-11	Feb.15	9	OP	SUR		D	S	VV		STK		Y	4	Y	I	R	C	
	79-14												Y	2	Y				
419	74-15	Feb.28	9	OP	SUR								Y	4	Y				As 74-11 & 74-14
420	74-16		9	As	74-11								Y	4	Y				As 74-11
	74-12	As	for 5	74-1,			74-9,		74-10										
425	74-13	Feb.18	9	OP	ACT		M	B								L			Cleanup system isolation valve inoperatable
							?		MV.							M			- Manual trip 'blunder' failed to close
428	74-17	Mar.7	9	SD	ACT		?		SW. CB. EP							L	R	C	Loss of electrical power on two busses
429	74-18	Mar.8	9				D	S	SH				Y	7	Y	L	R	C	As 74-3
430	74-19	Mar.9	9	CS	ACT		D	?	GG.		STK					L	R	C	Gauge sticking -
							O	O								S	I	C	Omitted to check recorder

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATIONAL MODE OF PLANT	DISCOVERY TYPE	SERIOUS	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/ SPONTANEOUS	IMMEDIATE/ REVEALED/ CHECK	INITIATING	DESCRIPTION 15 af 20
431	74-20	Mar.1[illegible]	9	RS	SUR		I, P	M	SL. MSIV		LK		Y	4	Y	L	R	C	Leaking because seal was cut to install, instead of dismantling
438	74-21	Mar.1[illegible]	9	OP	ACT		?		XV. PG							S	I	I	Bypass valve open
446	74-22	Mar.1[illegible]	9	OP	SUR		D		DS. C		Drift		Y		N	L	R	C	As 74-1
449	74-23	Mar.1[illegible]	9	OP	SUR		D	S	FS. RHR		Drift		Y	2	Y	L	R	C	
456 468	74-25	Apr.9	10	OP	SUR		?		W. C		LK		Y	2	Y	L	R	C	
457, 540	74-24	Apr.	10	OP	ACT		O	O	FL. OGS							S	I	I	Omitted to measure off gas filter activity
460	74-26		10				C		PM. ESW							L			Emergency service water pump failed to operate
469	74-29	Apr.17	10	Bergen Patterson shock absorbers again									Y	3	Y				
476	74-28	Apr.19	10	RS	SUR		M	A	LS MV. CS							L	R	C	
484	74-29		10	RS	SUR		D	S	PS. ADS		Drift		Y	2	Y	L	R	C	

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486		Apr.24	10	RS	SUR		C	M	MV. ADS, C		CRK					L	R	C	Crack in butterfly valve disc
500 509	74-30	May 14	10	RF	SUR		M	M	PS. TURB		Drift					L	R	C	
505	74-33	May 21	10	RF	SUR		P	L	TI. ADS		TIM		Y	2	Y	L	R	C	7 seconds extra delay on ADS
508	74-52	May 21	10	RF	SUR		?		PS. CS		CIR					L	R	C	Mercoid pressure switch failed open
511	74-31		10		Bergen Patterson								Y	2	Y	L	R	C	
512 548	74-34	May 28	10	RF			C		PEN		LK					S	I	I	Leakage in instrument penetration (LOCA-minor) (0.02 gal/hr.)
520		May 25	10	SU	ACT		D	Mod, O		PS. CS			Y	2	Y	L	R	C	Reset trip point
							D												Several switches on one alarm
							O												Operator did not reset
529	74-35	Jul.5	10	SU	SUR		D	S		PS. MSIV			Y	4	Y	L	R	C	Barksdale switches, As 74-1
530	74-36	July	10	OP	SUR		D	S		PS. RPS						L	R	C	Another Barksdale switch
545	UE 74	July	10		SUR		D	O		W. C			Y	2	Y	L	R	C	Activation of main line drain isolation valves omitted

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546	74-37		10										Y	4	Y				Barksdale switches again. As 74-1
552	74-40		10	Bergen Patterson again										1					
557	74-38	July 74	10				D	S	HV MSIV		TIM					L	R	C	New activation design on these valves
558	74-39	July 14	10	RF	SUR		D	Z	PS. ADS	Drift			Y	4	Y	L	R	C	
559	74-41	July 19	10	OP	SUR		D	S					Y	2	Y	L	R	C	Barksdale switches again as 74-1
560	74-42	July 25	10										Y	4	Y				Ditto
564		Aug.8	10		ACT		?		PM. RPS										
566	74-44	Aug.9	10	As	74-1		Barksdale switches							1					
568	74-43	Aug.2	10											1					
582	74-46	Aug. 26	10	OP	SUR		D	S, U	VV. C		JAM		Y		N	L	R	C	Teflon 'growth' in hinge
588	74-47		10	Bergen Patterson shock absorbers										2					
596	74-48	Sep. 25	10	OP	ACT		1									S	I	I	Scram - load rejection
							D	Z	RHR				Y	2	Y	L	R	C	Both heat removal systems out

DOCKET NUMBER	OCCURRENCE NUMBER	DATE	SIX MONTH PERIOD NO.	OPERATING STATE OF PLANT	DISCOVERY TYPE	SERIOUS	CAUSE	CAUSE SUBCLASS	COMPONENT TYPE	FAILURE MODE	FAILURE MECHANISM	RECOVERY MECHANISM	COMMON MODE EFFECT	COMPONENTS AFFECTED	COMMON MODE CONSEQUENCE	LATENT/ SPONTANEOUS	IMMEDIATELY REPAIRED	[illegible]	DESCRIPTION
597	74-49		11	Barksdale switch again										1					
599	74-50	Oct.4	11	OP	ACT		M	M	CB MV. C		BLK					L	P	C	
602	74-52		11	Barksdale switch again										1					
603	74-55	Oct. 18	11	OP	SUR		?		PM. CS							L	R	C	